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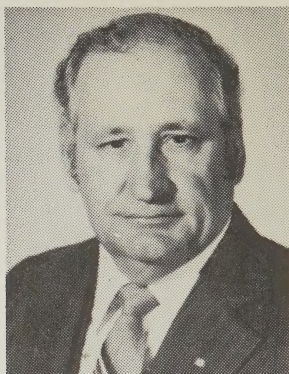


Energy for Agriculture and Food

**Questions and Answers
for the Farming Community**



Agriculture
Canada



ENERGY AND THE FARM COMMUNITY

When you bite into a pork chop or a carrot, it's not very likely you think about the gas and oil and electricity that brought you that food.

I don't blame you.

For years, the cost of energy for food production, processing and distribution has been almost negligible.

All that changed in 1974 when world oil prices increased by almost four-fold in one year. In 1979, world prices were about eight times higher than they were in 1972.

While Canadian farm fuel prices in 1979 were only double the 1972 level, they are on the rise. These price rises, which take Canadian realities into consideration, will help make Canada energy-secure in 10 years.

By ensuring adequate fuel supplies, we will help to ensure adequate food supplies, because the two are closely related. Fossil fuels are essential to producing human fuels — food.

This booklet discusses some of the major questions that I am asked about how rising energy costs will affect the agri-food industry.

I hope you find it useful.

A handwritten signature in cursive script that reads "Eugene F. Whelan".

Eugene F. Whelan
Minister of Agriculture

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INTRODUCTION

This booklet will provide readers with an overview on the current energy situation and outlook in Canada and it answers questions which have been raised by the farming community.

The escalation in world oil prices, initiated by the Organization of Petroleum Exporting Countries (OPEC) in 1973, has had world-wide economic repercussions. World prices have risen more than 700 percent since 1972. In Canada, however, because of Federal Government policies, oil prices have increased by about 350 percent. Retail fuel prices are only about 100 percent higher.

In 1973, Canada's oil production peaked at 1.8 million barrels per day. Canada has gone from a country which imported 90 percent of its requirements in 1947, to one which was nearly self-sufficient in 1968, to again a significant net importer of crude oil by 1975.

Annual consumption of motor gasoline and diesel fuel in Canada by all users has increased from 196 million barrels in 1968, to 263 million in 1973, and again to 333 million in 1979. In recent years the annual increase in consumption has been about 3 percent but, in 1979, it was over 6 percent. The increase in 1980, however, was less than 2 percent: 1 percent for gasoline and 4 percent for diesel fuel, on the basis of data for the first eight months.

The food system, which comprises farm production, food processing, packaging, transportation, distribution and household preparation, uses about 15 percent of all the energy in the economy in direct forms. Farm production accounts for about 18 percent of the food system energy use in both direct and invested forms but only about 3 percent of the total direct energy in the economy.

In the past decade, the overall increase in use of refined petroleum products in farming has been modest. The total increase between 1968 and 1973 was less than 6 percent and it was less than one percent between 1973 and 1979. In the Canadian food and beverage manufacturing sector, use of refined petroleum products has decreased sharply. At the same time, use of other energy forms, principally electricity and natural gas, has increased to the extent that the total energy purchased (in constant dollar terms) is not much more today than in 1973 and less than in 1968.

WHAT IS THE PRESENT ENERGY SITUATION?

When all sources of energy: crude oil, coal, natural gas, hydroelectric, biomass and nuclear energy are considered, Canada is an energy-rich country. In fact we are a net exporter of energy. At the same time, however, net imports are almost 25 percent of our total oil consumption. For the past several years, the amount of new oil discovered in Canada has not been sufficient to replace our current oil production. Reserves of easily accessible oil are on the decrease even though we have sharply reduced exports. On the other hand, net additions to our natural gas reserves continue to grow as new discoveries outstrip annual consumption rates.

The principal Canadian sources of energy, as percentages of all energy produced in Canada are: crude oil (44%), hydroelectric (23%), natural gas (18%), coal (9%), nuclear (3%), and biomass such as wood and charcoal (3%). The principal forms of energy consumption, as percentages of total use, are: refined petroleum products (53%), natural gas (24%), hydro and nuclear electricity (18%), and others (5%). By economic sector, our use of all forms of energy, as percentages of total use, is as follows: industrial (32%), transport (29%), residential (20%), other commercial, institutional and public administration (16%), and farming (3%)*.

While the farm sector is a relatively small user in the total economy of all forms of energy, it is an important user of refined petroleum products accounting for 7 percent of the gasoline and 11 percent of the diesel fuel used. It is, therefore, our heavy dependence on refined petroleum products, both in farming and in the economy as a whole, which makes our present energy situation a difficult one, especially for liquid fuels.

HOW DO CANADIAN FUEL PRICES COMPARE?

Canadians, including farmers, pay the lowest retail prices for fuel and their fuel taxes are also among the lowest for Organisation for Economic Co-operation and Development (OECD) countries. Selected prices in Canadian cents per litre compared with those in some OECD countries in June, 1980, are shown in the table on page 6.

*The proportion used in farming includes some home and personal use to the extent that it cannot be readily separated from business use, especially for heating oil.

	Regular Leaded Gasoline	Diesel Oil	Home Heating Oil
	cents per litre		
Canada	26.4 (7.7)	22.2 (3.3)	16.5
U.S.A.	36.8 (4.5)	33.9 (4.5)	31.4
U.K.	75.3 (36.7)	76.8 (36.9)	37.4 (2.1)
West Germany	78.1 (37.8)	77.7 (36.2)	48.1 (6.0)
France	90.7 (51.9)	68.1 (31.6)	45.5 (10.9)
Italy	94.7 (58.0)	45.0 (9.0)	26.9 (4.2)

The figures shown in brackets are the taxes per litre, which are included in the price. In Canada, farmers and other businessmen do not pay provincial fuel taxes in off-road uses. Also, the federal 1.5 cents-a-litre excise tax on automotive gasoline for personal use is refundable to farmers (and others) when specified conditions are met. Farmers (and all other users) do, however, pay a 9 percent federal sales tax on gasoline and diesel fuel. Fuel oil for heating or lighting is exempt from this tax. Two provinces, Alberta and Saskatchewan, subsidize farm fuel prices. Alberta has no provincial sales tax.

DO FUEL PRICES NEED TO RISE IN CANADA?

The development of principles to govern oil pricing in Canada has been a matter of national debate since the Arab oil embargo of 1973-74. Canada's National Energy Program, announced by the Government of Canada in October 1980, states that it is committed to a single price for crude oil in Canada, subject to transportation differences. The Federal Government is also committed to gradual increases in the price of oil in order to foster the development of new supplies and encourage conservation, while allowing Canadian consumers time to adjust to higher prices.

As the National Energy Program points out, there is a broad consensus that oil prices in Canada should rise substantially but they should also rise in a predictable fashion and reflect Canadian realities. The Program aims to translate Canada's relative strengths in oil and other energy into a competitive advantage for Canadian industries, including agriculture, through prices that are below those prevailing in other industrialized countries.

The oil pricing schedule, as set out by the National Energy Program, provides for predictable price increases to 1990. The price schedule will provide growing revenues for the petroleum industry, and thereby ensure substantial funds to support oil exploration and development. At the

same time it provides an attractive and certain prospect for investors. These prices also provide fair and growing payments to the producing provinces for the use of their oil.

The overall goal of the National Energy Program is to achieve energy security within a decade. The centre-piece of the Program is a drive to reduce oil consumption, through conservation efforts and the use of more plentiful fuels in place of oil. Success of the Program depends heavily on the pressure of rising prices, hence the need for fuel prices to rise in Canada. At the same time, a grants system will help home owners, including farmers, convert from oil heating to natural gas, electricity and other fuels. Taxable grants will be provided to encourage commercial motor vehicle operators, including farmers, to convert to propane. The level of assistance proposed is a \$400 grant per vehicle.

HOW ARE FARMERS' COSTS AND INCOMES AFFECTED?

Initially, farmers pay higher prices for fuel, and also for fertilizers and pesticides since petroleum and natural gas are significant inputs in their production, when oil prices increase. Other farm inputs with significant energy and transportation cost components would also increase. Grain production costs would rise if these input costs rose and livestock feed prices could likewise increase. The magnitude of these increases is not the same for each region of Canada, however, nor for each type of farming since varying quantities of these energy-based inputs are used. Below are estimates of the magnitudes of these increases in response to an assumed \$1-a-barrel increase in crude oil prices, together with a \$5.30 increase for a thousand cubic metres (a 15-cent increase for a thousand cubic feet) of natural gas.

Nitrogen fertilizer would increase by \$1.28 a kilogram of active ingredient, phosphate by 55 cents and potash by 37 cents. These increases mean that urea fertilizer would be \$5.88 a tonne higher, anhydrous ammonia up \$10.54, diammonium phosphate up \$4.85, muriate of potash up \$2.21 a tonne, and blended 8-32-16 fertilizer would be \$3.38 a tonne more.

Gasoline and diesel fuel would cost about four-fifths cents a litre (4 cents a gallon) more. Pesticides would increase by less than 1 percent.

Continuing the assumption through to total production costs, wheat and barley production costs on summer-fallow in Western Canada would be 46 to 48 cents an

acre greater and rapeseed about 57 cents more. Wheat and barley grown on stubble would cost 63 cents an acre more to produce, and rapeseed on stubble 78 cents an acre more. In Central Canada, grain corn production costs would be \$2 an acre greater, soybeans 61 cents more, barley up 50 cents, and winter wheat 65 cents higher. Potatoes in Atlantic Canada would cost \$3.22 more an acre to produce; oats and barley, 78 cents more. Fuel costs for an average Ontario greenhouse would increase by about \$1,200.

Livestock feeding costs in Western Canada would increase as follows: hogs 37 cents a head, feedlot finished beef \$1.16 a head, cow-calf 63 cents a head, and eggs 18 cents a 100 dozen. In Central Canada the cost increases would be: eggs 20 cents a 100 dozen, broilers two-fifths cents a bird, and dairy \$3.11 per cow. In Atlantic Canada the increases would be: hogs 37 cents a head; dairy \$2.24 a cow; and feedlot finished beef \$1.87 a head.

The income effect of the assumed price increases for crude oil and natural gas would be to lower net farm income per acre 2.8 percent in Western Canada, 1.6 percent in Central Canada and 1.5 percent in Atlantic Canada.

In terms of effect on retail food prices, the initial impact of a \$1-a-barrel increase for crude oil and a \$5.30-a-thousand-cubic-metres increase for natural gas would be increases of .2 to .5 percent, depending on the item. The food component of the Consumer Price Index would increase .35 percent.

It should be emphasized that these cost impacts are estimates of what the result would be in the short term from the given energy price increases only with no changes in other input prices resulting from, for example, higher fossil-fueled transportation costs, no substitutions of inputs, and no changes in farm product prices. It should be noted, also, that the prices of some important farm inputs are determined in world markets. Consequently, if world energy prices are higher than Canadian prices, then the Canadian prices of energy-rich inputs such as nitrogen fertilizers and pesticides will reflect the world prices. Finally, while farm input prices are generally rising, so are farm product prices. And, while energy prices will rise, the medium term outlook is for strong world grain prices.

DOES THE FEDERAL GOVERNMENT SUBSIDIZE FARMERS' ENERGY COSTS?

The National Energy Program provides for a gradual shift over time to a new oil price system designed to blend

the costs of oil from different sources, including imported oil, into one weighted-average price. This will ensure that oil price increases do not result in hardship for individuals, farmers and other businesses. Until the system is fully in operation, the Government of Canada will provide substantial subsidies to all consumers, including farmers, out of its general revenues to offset the difference between the domestic crude oil price and the cost of imported crude. To further subsidize farmers' energy costs would increase costs to the taxpayer even more and delay the necessary adjustment to higher energy prices with improved efficiency in energy use, as envisaged under the National Energy Program. Moreover, such subsidies would damage the competitiveness of the domestic enterprises receiving them and would be difficult to change. Subsidies on farm inputs commonly become built into the capital value of the enterprises receiving them, especially the fixed assets, increasing farm production costs.

When the National Energy Program is fully in effect, prices for crude oil in Canada will still remain significantly below world prices. This will permit Canadian farmers to maintain their competitive advantage in world markets.

COULD WE GO BACK TO THE HORSE?

Canadian farmers of 50 years ago were largely self-sufficient in terms of their fuel needs; the "fuel" they used was the hay and grain which they grew and fed to their work animals. There are many people today who believe that a return to these more simple times would benefit us all. This is not necessarily so. The farmer of 50 years ago had at his disposal perhaps a total of 10 horsepower while the farmer of today commands several hundred horse-power. In the 1930s, one farmer through his production for market, provided the food and fibre to support about 10 other persons. Today, he produces sufficient quantities to support more than 50 other persons.

In order to maintain this high level of productivity the farm operator requires the use of "energy-intensive" liquid fuels. Thus, any attempt to return to the use of animal power in Canadian farming has many implications:

- it would probably take about 20 years to raise the number of horses needed to meet today's demand for power;
- a large increase in farm workers would be necessary;
- a large part of the farm production would have to go to feed the horses, leaving less for food and likely higher food prices.

Even at current and anticipated prices for liquid fuels, it is still more economical to produce farm products using liquid fossil fuels, intensive mechanization, and petroleum-based inputs such as nitrogen fertilizers and pesticides rather than return to a labor and animal-intensive agriculture. This is not to deny that at some time in the future farmers may be able to produce some of their own liquid fuel requirements economically, using products of their own farms. But it would still be difficult, if not impossible, to maintain current levels of farm output without the use of chemical fertilizers and pesticides.

HOW IS THE FEDERAL GOVERNMENT HELPING?

The federal government, through Agriculture Canada, began funding research into alternate energy sources for farmers in 1974. To date research has been carried out in several areas of alternate energy technology including alcohol fuels, wind, solar, methane, waste heat utilization and the use of biomass. Projects completed include the demonstration of new technology as well as obtaining performance data for older technologies. Here are some examples of work done under Agriculture Canada funding:

- A study was carried out in Ontario to test the idea of an integrated solar heat collector and storage device to provide supplemental air ventilation heat in animal housing. Designed into the building structure and forming one wall, the method consists of glazing over a hollow, concrete block storage wall. This design allows every bit of heat gained in the collector to be used once the storage reaches its maximum temperature. With an estimated payback period of 3 to 7 years, this device holds considerable promise.
- A study has been done across Canada to assess the potential of wind generators, as well as analyzing some common wind utilization systems. From this study it was apparent that the feasible application of wind power is limited to several site-specific areas, and then only when displacing electricity generated from fossil fuels. Overall, wind power is not economically attractive at present.
- Several studies are under way to determine the feasibility of using industrial waste heat, especially from power generating stations. This appears to be

a promising technology, especially for greenhouse production. As well, a study is under way to determine the viability of using heat generated during composting to supplement a greenhouse heating system.

- There is considerable interest today in the possibilities for producing fuel alcohol from farm crops, animal wastes, crop residues and culls, and food processing wastes. These fuel sources, along with forestry products, are collectively known as "biomass". A number of studies are being conducted by Agriculture Canada to assess the potential for alcohol fuel production from biomass; to develop more efficient procedures; and to evaluate the economic viability of various scales of operation. With fossil fuel prices generally increasing more rapidly than other input costs, the economic possibilities for producing fuel alcohol from agricultural (and non-agricultural sources) are enhanced. Presently, however, alcohol is more costly in Canada than fossil fuels and it cannot compete in price unless exempted from the taxes usually levied on fossil fuels. Another potential liquid fuel source is Canada's oilseed crops, several of which produce oil that can be substituted for diesel fuel. A project in Saskatchewan is investigating rapeseed oil as a tractor fuel.
- It is becoming increasingly recognized that energy conservation measures are the best immediate solution. For this reason, conservation will be a major initiative in the 1980s and much of the funds allotted by Agriculture Canada for research into energy are being used for the development of conservation techniques. Some examples of projects include: development and testing of a fuel monitor to allow farmers to operate their equipment more efficiently with a subsequent saving; evaluation of a new crop dryer which has demonstrated a smaller appetite for fuel than existing dryers; a crop dryer and water heater fueled by straw has been successful in tests and experience is being gained on its operating characteristics; and heat exchangers and heat recovery devices for livestock structures are being perfected. Since greenhouse growers have been particularly affected by fuel cost increases, emphasis is being placed on energy-conserving techniques such as thermal blankets, insulation and more heat-efficient designs for both existing and future greenhouses.

WHAT CAN THE FARMER DO?

As energy, especially liquid fossil fuels, becomes relatively more expensive, it will be profitable to adopt even small changes which can result in energy savings. For example, machinery and motor vehicle fuel consumption can be reduced by careful adherence to recommended speeds of operation and to maintenance schedules. Savings in liquid fossil fuels for crop drying can be accomplished by use of low-temperature drying systems and by use of non-liquid fuels such as natural gas, propane, electricity and solar heat. Then, too, under the right conditions, the use of larger capacity farm equipment, the combining of field operations, and the substitution of herbicides for tillage operations to control weeds can all produce fuel savings in crop production.

Energy savings in crop production can be accomplished by careful monitoring of fertilizer, pesticide and irrigation water use. The use of high analysis fertilizers reduces the transportation energy component of fertilizers and the use of legume crops in rotations, where feasible, can reduce nitrogen fertilizer requirements. Better use of irrigation water can be accomplished through use of more efficient pumps, application timers and the use of electrical resistance blocks to measure water penetration.

In livestock production, opportunities exist for reduced use of liquid fossil fuels through substitution of other energy sources, improved insulation and ventilation, recovery of heat from exhaust air, and better equipment maintenance. Providing the correct controlled housing temperature for the animals or birds involved, rather than for the comfort of the operator, can reduce energy needs without sacrificing output.

Savings in fuel and other energy costs in farming are almost always possible but these savings usually cannot be accomplished without an increased investment in capital and management. Increased operator labor time may frequently be necessary too. Nevertheless as energy prices rise, the benefits from these investments for the farmer will become more obvious and the rate of payback accelerate. For the immediate future, more efficient use of existing petroleum fuel supplies and other petroleum-based inputs through the technology now available or being developed, together with the substitution of natural gas, propane and electricity for liquid fossil fuels, as outlined in the National Energy Program offer the greatest hope for both conserving our dwindling oil supplies and minimizing the effect of rising oil prices.

HOW IS THE FEDERAL GOVERNMENT WORKING WITH OTHER LEVELS OF GOVERNMENT, UNIVERSITIES AND INDUSTRY?

The adjustment necessary from a situation where energy has been relatively cheap and plentiful in Canada to one where energy is relatively more costly and less plentiful, especially for petroleum fuels, is one which will require special efforts from everyone. As stated in the National Energy Program, generations of Canadians have come to consider reliance on oil as the normal way of doing things. This perception, while possibly justified in a period when oil was relatively cheap and plentiful, must change to take account of the new realities.

The federal government has allocated a total of \$114 million to be spent under energy cost-sharing agreements with the provinces and the private sector between 1979 and 1985. These funds are to develop demonstration of promising technologies in renewable energy and conservation in order to promote their adoption. Possible demonstrations in agriculture could include industrial waste heat applications in greenhouse production and minimum tillage crop production systems. The provinces are taking the initiative in developing projects.

Agriculture Canada's own program in Agricultural Engineering Research and Development (AERD) provides funds for projects with industry, universities, other agencies and individuals in energy conservation technologies, renewable energy from biomass, and solar and wind energy applications for agriculture and the food system. Total funding in 1980-81 of energy-related projects is \$1 million. One project funded under this program has been a study by the University of Manitoba of the feasibility of using methane gas produced from animal waste. Between January 1974 and March 1979 this project received approximately \$324,000. The AERD program also supplements the agricultural engineering work carried out within the Research Branch of Agriculture Canada. This branch now has a staff of eight concentrating on energy. Expanded work on energy is planned for other branches in the department.

The federal government is encouraging greater energy efficiency in industry and small business by various means. For example, the government has sponsored the formation of voluntary energy conservation task forces covering 15 major sectors of industry (excluding farming) and accounting for close to 85 percent of industrial energy consumed. The task forces set 1980 targets for reductions in energy consumed per unit of output ranging from 3 percent for the ferrous metals industry to 18 percent for

oil refining from a 1974 base. The target set for the food and beverage industry was 15 percent. The sector is expected to have met this goal by the end of 1981 and it has established a new goal of 22.6 percent for 1985. A similar energy conservation task force is being considered for the primary agriculture sector.

In summary, in order to assist the agriculture and food system to adjust to higher energy prices, the federal government is involved in a variety of energy research, development and information programs:

- under cost-sharing agreements with the provinces;
- through contract research with industry, universities and others;
- through its own research in agricultural engineering and economics.

WHAT ARE THE EMERGENCY FUEL SUPPLY PLANS?

Under the Energy Supplies Emergency Act, 1979, the Energy Supplies Allocation Board was established to deal with national emergencies caused by actual or anticipated shortages of petroleum or a disturbance in the petroleum market considered severe enough to affect the national security, welfare and economic stability of Canada.

The Board is under the general direction of the Minister of Energy, Mines and Resources. It does not have the power to administer a contingency program for the allocation of petroleum until a national emergency is declared by the Governor-in-Council and approved by Parliament.

The Board is authorized, however, to prepare, review and maintain contingency allocation plans and to carry them out when required. These plans consist of a crude oil allocation plan, a petroleum products allocation plan, a gasoline rationing plan and their associated information systems. **The crude oil allocation plan** is designed to allocate to refineries on an equitable basis available crude oil from off-shore and domestic sources. **The petroleum products allocation plan** is designed to restrain demand and distribute products to wholesale customers in accordance with predetermined priorities and historical purchasing patterns. **The gasoline plan** is designed to ensure that available supplies of motor gasoline are shared equitably among retail consumers. The Board would also be empowered to make regulations prescribing the price at which, or a range of prices within which, any controlled product may be sold.

Under the proposed mandatory petroleum products allocation program, primary food production and the processing of essential perishable food products will be given the highest priority rating by the Energy Supplies Allocation Board in the event of an emergency in order to maintain the flow of essential foods to the public.

Canada is a member of the International Energy Agency (IEA) which would operate an international oil sharing program among its 21 members in the event of a severe international shortage of petroleum. This agency was established following the oil embargo of late 1973 so that in future no single member country would bear the brunt of a serious disruption of petroleum supplies. The group as a whole would share the burden of the affected nation or nations. Thus, even without a disruption of oil shipments to Canada, it could become necessary for Canada to implement a mandatory petroleum allocation program to meet its commitments to the IEA.

ARE THERE ANY OTHER PUBLICATIONS WHICH CAN BE CONSULTED?

Yes. The following publications are available from *Information Services, Agriculture Canada*, Ottawa, Ontario K1A 0C7

- (a) Alcohol Fuels from Agriculture — A Discussion Paper
- (b) Farm-Scale Production and Use of Fuel Alcohol: Opportunities and Problems, Publication 1712, 1980
- (c) Conserve Today to Consume Tomorrow, Publication 1707, 1980

And from *Energy, Mines and Resources Canada*, Ottawa, Ontario K1A 0E4

- (a) Answers to Your Energy Questions
- (b) Energy Update
- (c) Energy Futures for Canadians (Summary)
- (d) An Energy Strategy for Canada (Summary)
- (e) The National Energy Program 1980
- (f) 100 Ways to Save Energy and Money in the Home
- (g) Energy Conservation is Good Business
- (h) The Car Mileage Book

And from *Transport Canada*, Public Affairs Branch, Ottawa, Ontario K1A 0N5

Fuel Consumption Guide (for Automobiles and Light Trucks).

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